DOE/ID-10985
Revision 0
February 2003

U.S. Department of Energy
Idaho Operations Office

ICDF Complex Waste Verification Sampling and Analysis Plan

INEEL
Home of Science and Engineering Solutions
Idaho National Engineering and Environmental Laboratory

DOE/ID-10985
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Prepared for the
U.S. Department of Energy
Idaho Operations Office

ABSTRACT

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) wastes generated within the boundaries of the Idaho National Engineering and Environmental Laboratory (INEEL) will be disposed of at the INEEL CERCLA Disposal Facility (ICDF).

The purpose of this document is to provide the requirements for verification of untreated waste destined for disposal in the ICDF landfill. Verification is required to confirm that the key parameters in the waste (i.e., those parameters that limit acceptance of waste in the landfill as defined by landfill Waste Acceptance Criteria and/or operational limits) do not exceed the limits on the Material Profile.

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ACRONYMS

ALARA	as low as reasonable achievable
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	contaminant of concern
DOE-ID	Department of Energy Idaho Operations Office
DOT	Department of Transportation
DQO	data quality objective
EDF	Engineering Design File
EPA	Environmental Protection Agency
GC	gas chromatography
GC/MS	gas chromatography mass spectrometry
HWMA	Hazardous Waste Management Act
ICDF	INEEL CERCLA Disposal Facility
ICP	inductively coupled plasma
ID	identification
IDAPA	Idaho Administrative Procedures Act
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IWTS	Integrated Waste Tracking System
LCS	laboratory control sample
LDR	land disposal restriction
MDL	method detection limit
NESHAP	National Emission Standards for Hazardous Air Pollutants
OU	operable unit
OWTF	On-Site Waste Tracking Form
PCB	polychlorinated biphenyl

QA	quality assurance
QAPjP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RML	Radiation Measurements Laboratory
ROD	Record of Decision
SAM	Sample and Analysis Management
SDG	sample delivery group
SOW	Statement of Work
SSSTF	Staging, Storage, Sizing, and Treatment Facility
SVOC	semivolatile organic compound
TCLP	toxicity characteristic leaching procedure
TOS	Task Order Statement of Work
TRU	transuranic
TSCA	Toxic Substances Control Act
VO	volatile organic
VOC	volatile organic compound
WAC	Waste Acceptance Criteria
WAG	waste area group
XRF	x-ray fluorescence

ICDF Complex Waste Verification Sampling and Analysis Plan

1. INTRODUCTION

The U.S. Department of Energy Idaho Operations Office (DOE-ID) authorized a remedial design/remedial action for the Idaho Nuclear Technology and Engineering Center (INTEC) in accordance with the Waste Area Group (WAG) 3, Operable Unit (OU) 3-13 Record of Decision (ROD) (DOE-ID 1999). The OU 3-13 ROD requires the removal and on-Site disposal of some of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) remediation wastes generated within the boundaries of the Idaho National Engineering and Environmental Laboratory (INEEL).

The INEEL CERCLA Disposal Facility (ICDF) Complex is an on-Site, engineered facility, located south of INTEC and adjacent to the existing percolation ponds. Designed and authorized to accept not only WAG 3 wastes, but also wastes from other INEEL CERCLA actions, the ICDF Complex will include the necessary subsystems and support facilities to provide a complete waste management system.

The major components of the ICDF Complex include

- The disposal cells (landfill)
- An evaporation pond, consisting of two cells
- The Staging, Storage, Sizing, and Treatment Facility (SSSTF).

The ICDF Complex, including a buffer zone, covers approximately 40 acres, with a landfill disposal capacity of approximately 510,000 yd^3. The landfill meets the substantive requirements of Resource Conservation and Recovery Act (RCRA) Subtitle C (42 USC 6921 et seq.), Idaho Hazardous Waste Management Act (HWMA 1983), DOE Order 435.1, and Toxic Substances Control Act (TSCA) (15 USC 2601 et seq.) polychlorinated biphenyl (PCB) landfill design and construction requirements. The landfill is the consolidation point for CERCLA-generated wastes within the INEEL boundaries. The landfill will be able to receive CERCLA-generated wastes outside WAG 3 that meet the land disposal restriction (LDR) requirements (DOE-ID 2002a). Waste generated within the WAG 3 area of contamination that has not triggered placement is not required to meet LDR criteria.

This document details the waste verification requirements that must be performed for untreated wastes destined for disposal in the ICDF landfill. Verification is required to confirm that the key parameters in the waste, i.e., those parameters that limit acceptance of waste in the landfill as defined by landfill Waste Acceptance Criteria (WAC) and/or operational limits, do not exceed the limits on the Material Profile.

1.1 Purpose and Objectives

The purpose of this document is to provide the requirements for performing the verification of untreated wastes destined for disposal in the ICDF landfill. The objective of waste verification is to confirm that key parameters in the waste do not exceed the limits on the Material Profile. Key parameters have been identified as those parameters that impact ICDF operations or limit acceptance of waste in the landfill, as defined by landfill WAC and/or operational limits. Key parameter groupings include

- Void space (applicable to debris waste only)
- Free liquids
- Transuranic (TRU) waste constituents ≥ 10 nCi/g
- Landfill contaminants of concern (COCs) that are ≥ 1% of the design inventory divided by the landfill WAC
- Volatile organics to meet substantive requirements of 40 CFR 264 Subpart CC
- LDRs
- Idaho Administrative Procedures Act (IDAPA) operational limits
- National Emission Standards for Hazardous Air Pollutants (NESHAP) operational limits.

1.2 Scope

This Waste Verification Plan provides the verification requirements for waste being disposed of to the ICDF landfill. Depending on the media being disposed of, verification can include visual inspection of the waste, administrative controls, a review of documentation and calculations, or verification samples. For soil wastes that require verification samples, the results for key parameters found in the wastes are compared to the Material Profile. This plan specifies the type of verification required for soil wastes, and, where applicable, the number of verification samples required to confirm that key parameters in the waste do not exceed the Material Profile. Requirements are also provided on field sampling activities, acceptable measurement methods, sample control, and project quality objectives.

1.3 Relationship to Other Documents

This document is integrated with several existing ICDF Complex or Environmental Restoration Program documents, as discussed in the remainder of this section.

1.3.1 Quality Assurance Project Plan

The *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (DOE-ID 2002b), referred to as the QAPjP, provides quality assurance/quality control requirements for Environmental Restoration Program sampling activities. This document includes guidance on the number and type of quality control samples required for Environmental Restoration Program sampling activities, along with referencing standard analytical laboratory methods used for analysis and requirements for sample holding times and preservation.

1.3.2 ICDF Landfill WAC

This Waste Acceptance Criteria (WAC) document (DOE-ID 2002a) specifies the requirements for waste to be disposed of in the ICDF landfill.

1.3.3 Waste Tracking Plan

The "Waste Tracking Plan for the INEEL CERCLA Disposal Facility Complex" (PLN-914) describes the Material Profile and the INEEL Integrated Waste Tracking System (IWTS). Decisions on whether the verification samples meet their objectives are based on comparisons to the information specified in the Material Profile. IWTS will be used at the ICDF Complex to aid in the tracking of waste entering and leaving the facility to ensure complete, generation-to-disposition tracking of waste and will perform the administrative control part of waste verification.

1.3.4 Waste Characterization Guidance

The *ICDF Complex Material Profile Guidance* (DOE-ID 2003a) provides guidance for the waste generators on the type of information required on the Material Profile and on the importance of adequately characterizing waste streams. Waste characterization is the responsibility of the waste generator and it is assumed that associated sampling efforts have adequately characterized the key parameters found in the waste and specified on the Material Profile. As stated above, decisions on whether the verification samples meet their objectives are based on comparisons to the information specified in the Material Profile.

1.4 Report Organization

This document is organized in 11 sections and the appendix. Section 1 provides background ICDF information; discusses the purpose, objectives, and scope for verification; and provides the relationship of this document to other ICDF or Environmental Restoration Program documents. Section 2 describes the data quality objective process as it is applied to the verification of soil wastes. Implementation of and requirements for verification are discussed in Section 3. Sections 4 through 10 discuss the sampling and measurements methods associated with required verification sampling and provide guidance on sample control, data management, document management, and other Sampling and Analysis Plan activities. All references are included in Section 11. An appendix contains a procedure to determine the potential to generate free liquids during waste transport.

2. DATA QUALITY OBJECTIVES FOR WASTE VERIFICATION

To help with defensible decision-making, the U.S. Environmental Protection Agency (EPA) has developed the data quality objective (DQO) process, which is a systematic planning tool, based on the scientific method, for establishing criteria for data quality and for developing data collection designs (EPA 1994a). DQOs have been developed to guide monitoring and sampling at the ICDF Complex. The process consists of seven iterative steps that yield a set of principal study questions and decision statements that must be answered to address a primary problem statement. The seven steps composing the DQO process are listed below:

Step 1: State the problem

Step 2: Identify the decision

Step 3: Identify the inputs to the decision

Step 4: Define the study boundaries

Step 5: Develop decision rules

Step 6: Specify limits on the decision

Step 7: Optimize the design for obtaining data.

Waste verification requirements differ depending on the media being disposed of to the landfill. Verification requirements for debris waste, water resulting from WAG 3 CERCLA activities, or ICDF-generated non-soil wastes do not require additional verification sampling; therefore, the DQO process was not used. However, verification sampling is required for soil wastes and the DQOs that govern the waste verification requirements are presented in the following sections.

2.1 State the Problem

The problem for the verification of soil waste is to verify that those key parameters that could impact ICDF operations do not exceed the limits on the Material Profile. The key parameters are those contaminants or other characteristics that limit the operation of the landfill (e.g., WAC, IDAPA, NESHAP, LDRs). The limits on the Material Profile are assumed to result from waste characterization sampling efforts that adequately characterize the key parameters found in the waste and are assumed to be within the landfill WAC. Verification can include visual inspection of the waste, administrative controls, a review of documentation and calculations, or verification samples. The verification decision for each key parameter will be made based on a comparison to the Material Profile for that key parameter.

For most key parameters (all except free liquids), severity of contamination (specifically how close the concentration stated in the Material Profile is to the applicable limit) is a concern when verifying the Material Profile concentrations. Therefore, cutoff ranges are specified for most key parameters to distinguish the verification requirements. Cutoff ranges are not applicable to free liquid since either free liquid exists or it does not. For IDAPA and NESHAP key parameters, Material Profile concentrations will be compared to the applicable landfill WAC or operational limit using a cutoff limit of 80%. For LDR, landfill COC, and TRU key parameters, Material Profile concentrations will be compared to the applicable limit using cutoff limits of 20%, 70%, and 90%.

2.2 Identify the Decision

The principal study question to be addressed for the waste verification of soil waste is

> Do the waste verification results confirm that the specified percentage of the waste for key parameters do not exceed the upper limits on the Material Profile?

The alternative actions that will be taken based on the data collected are

> If the waste verification confirms that the specified percentage of the waste for key parameters do not exceed the upper limits on the Material Profile, then the waste can be placed in the landfill.
>
> If the waste verification does not confirm that the specified percentage of the waste for key parameters are within the upper limits of the Material Profile, then the waste stream will not be accepted at the landfill as is and corrective action will be taken to remedy the situation. At a minimum, the corrective action could include revision of the Material Profile by the waste generator, additional verification, including sampling, or rejection of the waste stream.

Combining the principal study question and the alternative actions results in the following decision statement:

> Determine whether the specified percentage of the waste for key parameters are within the upper limits of the Material Profile and that the waste can be accepted at the ICDF landfill, or whether modification of the Material Profile and/or corrective action are necessary.

2.3 Identify the Inputs to the Decision

The following will be required to resolve the decision statement associated with the waste verification:

- List of key parameters for the waste stream of interest
- Completed Material Profile addressing key parameters found in the waste stream
- Assessment of severity of key parameter contamination (based on closeness to the applicable limit)
- Results from required waste verification (e.g., visual inspection reports, analytical results)
- Constituent-specific action levels for key parameters, based on the Material Profile.

2.4 Define the Study Boundaries

The spatial boundaries of concern for this study are confined to the soil waste stream (including any verification samples taken) as identified on the Material Profile. Decisions for the waste stream will be made on a lot-by-lot basis. A lot is defined to be a volume of waste up to 5,000 yd^3. The temporal boundaries are confined to the actual time required to remove the waste from the site and take any required waste verification samples. The waste in question for this study is limited to soil waste destined for direct disposal at the landfill.

2.5 Develop Decision Rules

A decision rule defines the conditions that would cause the decision-makers to choose between the alternative actions and typically takes the form of an "If…then" statement describing the action to take if one or more conditions are met. This decision rule specifies the statistic of interest and the action level. For the waste verification study, the statistic of interest is the verification result from visual inspection, administrative controls, or analytical sample results; the action level is obtained from the Material Profile; and the decision rules are as follows:

> *If* the verification results for key parameters indicate that the specified percentage of the waste is within the upper limits on the Material Profile, *then* the waste can be accepted at the landfill.
>
> *If* the verification results for key parameters indicate that the specified percentage of the waste exceeds the upper limits on the Material Profile, *then* the waste stream will not be accepted at the landfill as is and corrective action will be taken to remedy the situation. At a minimum, the corrective action could include revision of the Material Profile by the waste generator, additional verification including sampling, or rejection of the waste stream.

2.6 Specify Limits on the Decisions

The Type 1 error is making the incorrect decision and saying that for any key parameter no more than the specified percentage of the waste may be in exceedance of the maximum specified on the Material Profile when for that key parameter more than the specified percentage of the waste exceeds the maximum specified on the Material Profile. The risk from Type 1 error is possible exceedance of the landfill WAC or operational criteria or possible procedural violation.

The Type 2 error is making the incorrect decision and saying that for any key parameter more than the specified percentage of the waste may be in exceedance of the maximum specified on the Material Profile when for that key parameter, no more than the specified percentage of the waste exceeds the maximum specified on the Material Profile. Decisions based on the results of verification sampling will be made using the simple exceedance rule (EPA 2002). Therefore, if none of the waste in a lot exceeds the maximum specified on the Material Profile, then there is no chance that the lot will fail the verification and hence no Type 2 error is possible.

For verification sampling, decision error limits will depend on the magnitude of the concentration specified on the upper limits of the Material Profile for a given key parameter with respect to the applicable limit. The Type 1 decision error limit for waste verification will range from 5 to 25%, depending on the concentration of the waste associated with a Material Profile, and will be set with the use of a simple exceedance rule (EPA 2002). Risks cannot be specified if verification sampling is not required.

2.7 Optimize the Design for Obtaining Data

The goal is to ensure that the key parameters in the soil waste being accepted at the landfill are as specified in the upper limits of the Material Profile. For most key parameters (all except free liquids), severity of contamination (specifically how close the concentration stated in the upper limits of the Material Profile is to the applicable limit) is a concern when verifying the Material Profile concentrations.

Therefore, cutoff ranges will be specified for most key parameters to distinguish what type of verification will be required. Cutoff ranges are not applicable to free liquid since either free liquid exists or it does not. For IDAPA and NESHAP key parameters, Material Profile concentrations will be compared to the applicable limits using a cutoff limit of 80%. For LDR, landfill COC, and TRU key parameters, Material Profile concentrations will be compared to the applicable limits using cutoff limits of 20%, 70%, and 90%.

Verification of soil wastes for free liquids will be conducted at the excavation site or from waste containers and will be performed through 100% visual inspection and the use of procedural controls. Visual inspections will ensure that no free liquid is visually present. Procedural controls will ensure that WGS personnel performing the inspections will simulate the transport vibration effect on soil waste by placing a representative sample of the waste in a porous bag and shaking it. Procedural controls will also consider whether there is a reasonable expectation of moisture in the waste, based on information found in the Material Profile and the impacts of any recent precipitation events. Procedure controls will address the addition of absorbent in waste containers. The procedural requirements for free liquids are provided in Appendix A of this Plan.

Verification of soil wastes with key parameters that are mass-based (i.e., IDAPA and NESHAP parameters) will be performed through administrative controls, which will be achieved through the use of IWTS.

Since verification is to ensure that the highest concentrations are within the upper limits of the Material Profile, sampling requirements for soil waste with LDR, landfill COC, and TRU key parameters will be based on a quantitative approach with specified Type 1 error rates. The recommended method in Section 3.4.2.2 of EPA (2002) is using a simple exceedance rule to determine with confidence ($1-\alpha$) that a percent (*p*) of the contamination does not exceed the upper limits of the Material Profile. This approach makes no distribution assumptions and does not specify power to reject the null hypothesis under a specified alternative. Analytical results will be necessary for verification of these wastes.

Table 2-1 summarizes the soil waste verification requirements for the IDAPA and NESHAP key parameter groupings (refer to Section 1.1 for a list of the key parameter groupings).Verification requirements for void space are addressed in Section 3.2.1, since void space is only applicable to debris wastes. Verification requirements for LDR, landfill COC, and TRU key parameter groupings are presented in Section 3.3, with sampling requirements provided in Section 3.3.4. Table 2-2 provides the applicable limits for LDR, landfill COC, and TRU key parameter groupings for use in applying the verification requirements. Specific verification requirements are not identified for some of the specific key landfill COC parameters identified in Table 2-2. Organic landfill COCs (2-nitroaniline, 3-nitroaniline, 4-nitroaniline) have only been identified at one site that will be disposing soil waste to the landfill. This site has a volume of less than 2% of the total 510,000-yd^3 volume of the landfill. Since the limits for the landfill COC key parameters are based on mass limits assuming a maximum concentration over the entire landfill, these parameters cannot limit operations of the landfill. Verification requirements are also not identified for ^{129}I, which is one of the radiological landfill COCs. ^{129}I is highly mobile and therefore is a major concern for groundwater primarily due to the contributions from release sites at INTEC. Therefore, for the release sites suspected of having detectable ^{129}I concentrations (e.g., CPP-36/91, -37B, -67, -92, -97, -98, and -99), the generator will be required to perform additional characterization of the ^{129}I curie content prior to completion of the Material Profile. The characterization and verification of ^{129}I for these sites will either be addressed in the sampling and analysis plan prepared as part of the Remedial Design/Remedial Action (RD/RA) Work Plan for the site or as a modification of the ICDF Remedial Action Work Plan (RAWP). As part of this effort, verification of ^{129}I may be achieved through the characterization. The ICDF landfill WAC limits for ^{129}I are 2.4 Ci. Based on this limit and the characterization results, the concentration guidelines may be adjusted to account for the expected volume of ^{129}I contaminated soil being placed in the ICDF landfill.

Table 2-1. Verification requirements for IDAPA and NESHAP key parameters in soil waste.

Key Parameter	Applicable Limit	Type of Limit (Document Reference)	Material Profile Compared to the Applicable Limit		Applicable Methods	
			< 80%	≥ 80%	<80%	≥ 80%
IDAPA[a]:						
Hexachlorobenzene Ethyl cyanide (as CN) Mercury	4.76 kg/day 2390 kg/day 74 kg/day	Mass-based operational (DOE/ID-10865, Appendix L, Table 5-2)	Administrative controls[b]	Administrative controls[b] and delay waste placement[c]	Technical procedure	
NESHAP[d]:						
^{137}Cs ^{129}I	113,360 Ci/yr 5.9 Ci/yr	Mass-based operational (ICDF RD/CWP DOE/ID-10848, Appendix O)	Administrative controls[e]	Administrative controls[e] and delay waste placement[f]	Technical procedure	

a. Key IDAPA parameters are defined as those parameters that have WAC guideline concentrations greater than the guideline concentration based on the mass-based operational limits.

b. Since IDAPA concerns are driven by operational limits that are mass-based, and not concentration-based, verification is performed by administrative controls. These administrative controls are achieved through IWTS scheduling checks performed in advance of waste receipt and in transaction checks performed at the time of waste receipt. These IWTS checks ensure that the total mass received for the day from all generators is below the limit.

c. For each of the IDAPA key parameters, if the total mass expected for the day is ≥ 80% of the daily limit, then some of the waste will be staged to delay placement and ensure that the total daily load is below 80% of the daily limit.

d. Key NESHAP parameters are defined as those parameters that were major contributors to the estimated yearly dose to the Site boundary as summarized in Table 8 of Appendix O of the ICDF Remedial Design/Construction Work Plan (DOE-ID 2002c). ^{129}I was identified as the major contributor to the landfill operation dose at 96.6%. ^{137}Cs contributed less than 2% to the landfill operation dose. All other sources contributed less than 1%. The limits shown are obtained from Table 3 of the same appendix, from the maximum yearly input and adjusted to maintain a maximum off-Site exposure of 1 mrem/year.

e. Since NESHAP concerns are driven by operational limits that are mass-based, and not concentration-based, verification is performed by administrative controls.

f. If administrative controls indicate that operational limits will be exceeded, the waste will be staged to delay placement and ensure that the operation limits are met

Table 2-2. Applicable limits for LDR, landfill COC, and TRU key parameters in soil waste.

Key Parameter	Landfill WAC Limit	Concentration Guideline[a]
LDRs[b]		
Volatile organics:	40 CFR.268.49	NA[c]
Semivolatile organics:	40 CFR.268.49	NA
Inorganics:	40 CFR.268.49	NA
Volatile organics	500 mg/kg[d]	NA
Landfill COCs[e]	—	—
Organic	—	—
2-Nitroaniline[f]	7.7E+01 kg[g]	NA
3-Nitroaniline[f]	7.7E+01 kg[g]	NA
4-Nitroaniline[f]	7.7E+01 kg[g]	NA
All other organic:	—	—
Toluene	2.2E+04 kg	5.0E+02 mg/kg
Inorganic[h]:	—	—
Arsenic	4.4E+04 kg	5.8E+01 mg/kg
Barium	2.3E+06 kg	3.0E+03 mg/kg
Beryllium	1.4E+04 kg	1.8E+01 mg/kg
Boron	2.5E+06 kg	3.3E+03 mg/kg
Cobalt	8.3E+04 kg	1.1E+02 mg/kg
Manganese	3.7E+06 kg	4.9E+03 mg/kg
Nickel	2.7E+05 kg	3.5E+02 mg/kg
Sulfide	2.5E+07 kg	3.3E+04 mg/kg
Thallium	3.3E+03 kg	4.3E+00 mg/kg
Vanadium	3.4E+05 kg	4.5E+02 mg/kg
Radionuclide:	—	—
^{129}I[i]	2.4 Ci	3.1E+03 pCi/kg
^{238}Pu	7.6E+03 Ci	1.0E+07 pCi/kg
TRU $\geq$ 10 nCi/g[j]	—	—
Total TRU	10 nCi/g	NA

Table 2-2. (continued).

Key Parameter	Landfill WAC Limit	Concentration Guideline[a]

a. Concentration guideline is based on the WAC divided by 510,000 yd^3.

b. Key LDR parameters are defined in 40 CFR 268.49 and apply to soil waste required to meet LDRs.

c. NA–not applicable.

d. The ICDF evaporation pond and landfill WAC limit the average volatile organic (VO) concentration at the point of waste origination to less than 500 ppm by weight; this limit ensures compliance with the substantive requirements of 40 CFR 264 Subpart CC per 40 CFR 264.1082(c)(1). Average VO concentration means the mass-weighted average volatile organic concentration of a hazardous waste (40 CFR 265.1081). The average VO concentration is determined in accordance with the Subpart CC "Waste Determination Procedures" (40 CFR 264.1083).

e. Key landfill COC parameters are defined as those parameters where the (Design Inventory/landfill WAC) $\geq$ 1% as listed in Table F-1 of the landfill WAC. For most key landfill COC parameters, the limits shown are the maximum concentration guidelines (from Table D-1 of the landfill WAC). Maximum concentration guidelines are used to determine the maximum mass allowed in the landfill, assuming the maximum concentration over the entire 510,000 yd^3 of the landfill, and are set to be protective of groundwater.

f. Verification for Nitroaniline is addressed under leachate quality assurance (QA) sampling.

g. For key organic landfill COC parameters, the limits shown are the mass limits rather than the concentration limits. Nitroanilines have only been identified at a single site with a volume of approximately 10,000 yd^3. Since the volume of waste with these parameters represents less than 2% of the total volume of the landfill (510,000 yd^3) these wastes cannot limit landfill operations.

h. Aluminum, iron, magnesium, and potassium were excluded from the list of inorganics since they were identified in Table D-1 of the landfill WAC as being 10 X background.

i. Applicable concentration guidelines for ^{129}I may be modified to account for the expected volume of waste based on characterization results and the landfill WAC limit.

j. Key TRU parameters are those radiological parameters identified in Section 4.1.4.5 of the landfill WAC. These include ^{237}Np, ^{238}Pu, ^{239}Pu, ^{242}Pu, ^{244}Pu, ^{241}Am, ^{243}Am, ^{243}Cm, ^{245}Cm, ^{246}Cm, ^{248}Cm, ^{250}Cm, ^{247}Bk, ^{249}Cf, and ^{251}Cf.

3. WASTE VERIFICATION PROCESS

As stated in Section 1.2, verification requirements depend on the media being disposed of to the landfill. The waste handling at the ICDF landfill shall maintain worker exposure as low as reasonably achievable (ALARA) as specified in the landfill WAC (DOE-ID 2002a), in accordance with DOE Order 5400.5. Therefore, risks to workers have not limited allowable WAC concentrations or operational limits reflected in Tables 2-1 and 2-2. Should ALARA concerns arise with any of the waste being verified, verification of that waste will cease and the proper path forward will be determined with the Agencies on a Material-Profile-specific basis. This section describes the verification process for the various media, assuming no ALARA concerns are identified.

3.1 Verification Requirements for WAG 3 Water and ICDF-Generated Wastes

Water resulting from WAG 3 activities will be direct disposed of to the ICDF evaporation pond and not to the landfill. Contaminant concentrations reported from the waste characterization activities of these water wastes are representative of the concentrations in the water itself. The results of the waste characterization will be required prior to completion of the associated Material Profile. The ICDF waste specialist will review analytical data from the waste characterization process against the associated Material Profile prior to approval of the Material Profile. Therefore, additional verification of these wastes is not required.

Wastes generated as a result of ICDF operations will be sampled and analyzed according to specifications in existing ICDF documents. Therefore, additional verification of these wastes is not required. Sampling and analysis requirements for wastes generated from ICDF groundwater monitoring activities are addressed in the *ICDF Groundwater Monitoring Plan* (DOE-ID 2002d), while sampling and analysis requirements for other ICDF sample streams are covered in the *ICDF Complex Operational and Monitoring Sampling and Analysis Plan* (DOE-ID 2003b).

3.2 Verification Requirements for Debris Waste

Debris waste will be accepted at the landfill if the waste meets the landfill WAC. It is expected that some generators will have already containerized their debris waste prior to initiation of ICDF Complex operations. Some debris wastes will require treatment prior to disposal, and thus will not be direct disposed of to the landfill. Treatment requirements for debris waste are addressed in the *ICDF Complex Operations and Maintenance Plan* (DOE-ID 2003c). Since the debris treatment process is a performance-based standard, verification requirements for these debris wastes are not addressed in this plan. The following sections describe the verification process for the debris waste that does not require treatment prior to disposal at the landfill. Separate verification requirements are presented for debris waste for which the associated Material Profile indicates that transuranic (TRU) parameters have been detected.

3.2.1 Verification Requirements for Debris Waste Not Containing TRU Parameters

Debris waste that does not require treatment prior to disposal at the landfill will undergo verification. For debris wastes not containing TRU parameters, the two steps of this verification are (1) 100% visual inspection, either as the waste is being containerized or by opening the container and (2) verification of the associated documentation. (Refer to Section 3.2.2 for the verification requirements for debris waste that contains TRU constituents.) Visual inspection will ascertain that the waste contains material that meets the definition of debris as defined in 40 CFR 268.2 (g), and that each waste container identified on the profile as debris includes greater than 50% debris. Visual inspection will ensure that the specific type of debris waste being sent for disposal is as specified in the Material Profile. For containerized waste that remains in the intact container following disposal, verification will ensure that the waste fills at least 95% of the internal volume of the container thus limiting the void space to less than 5%. Verification of the documentation and/or calculations used to establish the Material Profile will be performed prior to approval of the Material Profile to ensure key parameters are adequately addressed and that the calculations are accurate. Refer to Section 1.1 for the key parameter groupings. Verification sampling will not be required for debris waste.

3.2.2 Verification Requirements for Debris Waste Containing TRU Parameters

Key TRU parameters are those radiological parameters identified in Section 4.1.4.5 of the landfill WAC. These include ^{237}Np, ^{238}Pu, ^{239}Pu, ^{242}Pu, ^{244}Pu, ^{241}Am, ^{243}Am, ^{243}Cm, ^{245}Cm, ^{246}Cm, ^{248}Cm, ^{250}Cm, ^{247}Bk, ^{249}Cf, and ^{251}Cf. The quantity of TRU radionuclides present in the debris waste will be specified by the waste generator on the Material Profile. Verification of the reported TRU content will be performed by an independent ICDF review of the Engineering Design File (EDF) prepared by the waste generator. The EDF prepared by the waste generator will contain the activities, or concentrations, of TRU parameters listed on the Material Profile. The independent ICDF review will be performed by a subject matter expert and, at a minimum, will verify the EDF contents for the following elements:

- Detailed list of known waste parameters including, but not limited to the following: waste composition, physical properties of final waste form (density, weight, dimensions, and void space in package), waste package material, radiological source term, radiological exposure rates for waste and/or waste package, and radioanalytical data.

- Detailed list of reasonable assumptions including, but not limited to the following: waste composition, density, void space, estimated radiological exposure rates, and estimated radiological source term.

- Description of calculation basis and methodology (i.e., hand calculations should include references for equations used, computer modeling should reference computer code users manual). The calculations/modeling should be explicit, and input parameters should match the known waste parameters and assumptions.

- Detailed list of the TRU radionuclides and the associated concentrations in the final waste form.

Verification of debris waste containing TRU parameters will not undergo visual inspection.

3.2.3 Assessment of Verification Results

Verification of debris waste will be performed independently of the waste generator's characterization and will be performed under the direction of the ICDF waste specialist (or designee). Debris waste that fails the visual inspection or the verification of the associated documentation will not be allowed in the landfill as is and corrective action will be initiated. At a minimum, the corrective action could include a revision to the Material Profile by the waste generator, or rejection of the waste.

3.3 Verification Requirements for Soil Waste

Depending on the key parameters and the severity of contamination, verification of soil waste can include visual inspection of the waste, procedural controls, administrative controls, or verification samples. Refer to Tables 2-1 and 2-2 for lists of key parameters. In most cases, severity of contamination will drive more stringent verification. The following sections specify the requirements for verification of soil waste.

3.3.1 Severity of Contamination and Application of Cutoff Limits

For most key parameters (all except free liquids), severity of contamination (specifically how close the concentration stated in the upper limit of the Material Profile is to the applicable limit) is a concern when verifying the Material Profile concentrations. Therefore, cutoff limits have been specified for most key parameters to distinguish what type of verification will be required. Cutoff limits are not applicable to free liquid since either free liquid exists or it does not. For IDAPA and NESHAP key parameters, Material Profile concentrations will be compared to the applicable limits using a cutoff limit of 80%. For LDR, landfill COC, and TRU key parameters, Material Profile concentrations will be compared to the applicable limits using cutoffs of 20%, 70%, and 90%. Wastes with key parameters at a greater percent of the applicable limit will require more stringent verification.

3.3.2 Visual Inspection Requirements

Visual inspections will not verify the key parameter contaminant concentrations specified on the Material Profile. Rather, visual inspections are required to ensure that the physical characteristics of the soil waste do not differ from the source characterization information, as specified on the Material Profile, or, in the case of free liquids, to visually look for, as well as implement procedural controls, to ascertain the presence of free liquids prior to shipment to the ICDF Complex. The visual inspections will be controlled by ICDF-specific technical procedures. One hundred percent visual inspection will be performed prior to disposal, either at the excavation site or at the ICDF.

Procedural controls for free liquids will address whether there is a reasonable expectation of moisture in the waste, the possibility of free liquids resulting during transport, and the addition of absorbent in waste containers. This determination of action will be based on a representative sample of waste being placed in a porous bag and shaken, information found in the Material Profile, and the impacts of any recent precipitation events.

3.3.3 Administrative Control Requirements

For those key parameters that are driven by mass-based operational limits (i.e., IDAPA and NESHAP), verification will be achieved through administrative controls. To verify the individual IDAPA key parameters, these administrative controls are achieved through IWTS scheduling checks performed in advance of waste receipt and in transaction checks performed at the time of waste receipt. These IWTS checks ensure that the total mass received for the day from all generators is below the applicable IDAPA limit. For NESHAP key parameters, the NESHAP limits are greater than the landfill WAC limits; therefore, by ensuring that the parameters are within the landfill WAC, the administrative controls will ensure that the parameters are below the applicable NESHAP limits.

Waste with key parameters that have reached ≥80% of the mass-based operational limits (either for a given day or year) will be staged to delay waste placement to ensure that the mass-based limit is not exceeded. For example, if IWTS indicates that the total mass expected for the day is ≥80% of the daily limit for any of the individual IDAPA key parameters, then some of the waste will be staged to delay placement and ensure that the total daily load is below 80% of the daily limit.

3.3.4 Sampling Requirements

In addition to visual inspections, verification sampling is required for key parameters with concentration-based limits (refer to Table 2-2). For volatile organics that are being compared to the 500-mg/kg limit, the limit applies to the average volatile organic concentration over the entire waste stream. Since the value reported on the Material Profile will most likely represent a maximum value, sampling will only be required for this key parameter if a review of the associated waste characterization data indicates that the average volatile organic concentration for the waste stream exceeds the 500-mg/kg limit.

The required verification sampling will be performed under the direction of the ICDF waste specialist (or designee). The objective of the waste verification sampling is to confirm that key parameters in a lot from the waste stream do not exceed the upper limits on the Material Profile. A waste stream is defined as waste or a group of wastes generated from the same process or facility with similar physical, chemical, or radiological properties with the same disposition pathway, as defined on a given Material Profile. A lot from a waste stream is at most 5,000 yd^3. Waste generators are encouraged to submit as many Material Profiles as are needed to address differences in their waste stream (e.g., in concentration and/or contaminants) and to ensure homogeneity of the waste within a given Material Profile.

Wastes with LDR, landfill COC, and TRU key parameters will be verified by application of a simple exceedance rule (EPA 2002). The verification for a lot fails if one sample result exceeds the maximum concentration specified on the Material Profile. The percent of the waste that may not exceed the Material Profile and the confidence required will be based on the relative magnitude of the Material Profile compared to the applicable limit.

3.3.4.1 Sample Size. Using the guidance provided in EPA (2002) on exceedance rules, the number of samples required for waste verification can be determined. The simple exceedance rule provides specified confidence ($1-\alpha$) that a percent (p) of the data fall below the limit and does not require any assumptions be made about the distribution of the data. If the maximum verification sample result is used to compare to the Material Profile for a specified confidence and percent, the required sample size (n) can be determined using the following equation found in (EPA 2002).

$$n = \frac{\log(\alpha)}{\log(p)}. \qquad (3\text{-}1)$$

The simple exceedance rule will be applied to lots of at most 5,000 yd^3. There may be more than one lot from a single Material Profile or there may be a Material Profile with only one lot having volume at most 5,000 yd^3. The population units within each lot are defined to be a maximum of 50 yd^3 and a minimum of 15 yd^3. These population unit sizes are based on homogeneous waste from a given Material Profile. Only one sample will be collected from any given population unit, so that sample size may be limited by a small lot volume. The sample size for specified confidence and percent are specified for each lot within a Material Profile. Also, the decision to pass or fail verification is made on a lot-by-lot basis.

The required confidence and percent for the simple exceedance rule will depend on the concentration of the key parameter in the waste and the applicable limit (Table 3-1). The confidence and percent will be greater for wastes with concentrations closer to the applicable limit, based on the cutoff limits of 20%, 70%, and 90% for LDR, landfill COC, and TRU key parameters. For wastes with concentrations of LDR, landfill COC, or TRU key parameters <20% of the applicable limit, there will be 75% confidence that no more than 50% of the waste exceeds the upper limits of the Material Profile. For wastes with LDR, landfill COC, or TRU key parameter concentrations $\geq$20% and < 70%, there will be 90% confidence in the 75^{th} percentile. For wastes with LDR, landfill COC, or TRU key parameter

Table 3-1. Sample sizes for simple exceedance rule.

Concentration of Key Parameter as Percent of Applicable Limit	Percent (p)	Verification Confidence ($1-\alpha$)	Total Verification Sample Size for a Given Lot[a,b]
< 20%	0.50	0.75	2
≥20% and < 70%	0.75	0.90	9
≥70% and < 90%	0.90	0.90	22
≥90%	0.95	0.95	59

a. Lot sample size based on a maximum volume of 5,000 yd^3.

b. A maximum of one sample per population unit will be taken. The maximum size of a population unit will be 50 yd^3; the minimum size of a population unit will be 15 yd^3.

concentrations ≥70% and < 90%, there will be 90% confidence in the 90th percentile. For wastes with LDR, landfill COC, or TRU key parameter concentrations ≥90%, there will be 95% confidence in the 95th percentile. The sample sizes required for these percentiles and confidence levels are contained in Table 3-1.

The sample sizes in Table 3-1 are based on the assumption that all verification sample results must be below the maximum concentration specified on the Material Profile. Greater sample sizes will result if the decision rule allows one verification sample result to exceed the concentrations specified on the Material Profile. These sample sizes can be determined using tables in Appendix G of EPA (2002).

3.3.4.2 Sample Selection. Figure 3-1 presents the verification sampling process flow. Verification sample selection will be flexible to accommodate in situ waste and waste that is or will be containerized prior to verification sampling. However, for each Material Profile, verification sampling requirements will follow one approach; a mixture of in situ and container sampling approaches will not be allowed for a single Material Profile.

All verification samples taken, after the Material Profile is approved (refer to Figure 3-1), in support of the verification decision will be taken under the direction of the ICDF, by WGS personnel. Therefore, verification sample selection for a given Material Profile will be independent of any effort by the generator to select characterization samples used to complete the Material Profile.

For sampling in situ wastes, the volume of waste will be divided into lots of size no more than 5,000 yd^3 and the population unit will be a maximum of 50 yd^3. If the lot size is less than 5,000 yd^3, then the lot will be divided into approximately 100 population units, with a minimum population unit size of 15 yd^3. After being divided into lots, a three-dimensional grid of specified population unit size will be overlain. The required number of samples will be selected from randomly chosen grid cells. Using this approach, data from previously collected samples that fall within randomly selected grid cells can be used if they were collected and analyzed using comparable methods and are recent enough so that temporal change is not an issue. It is expected that only a few generators will have previously collected sample data meeting these criteria.

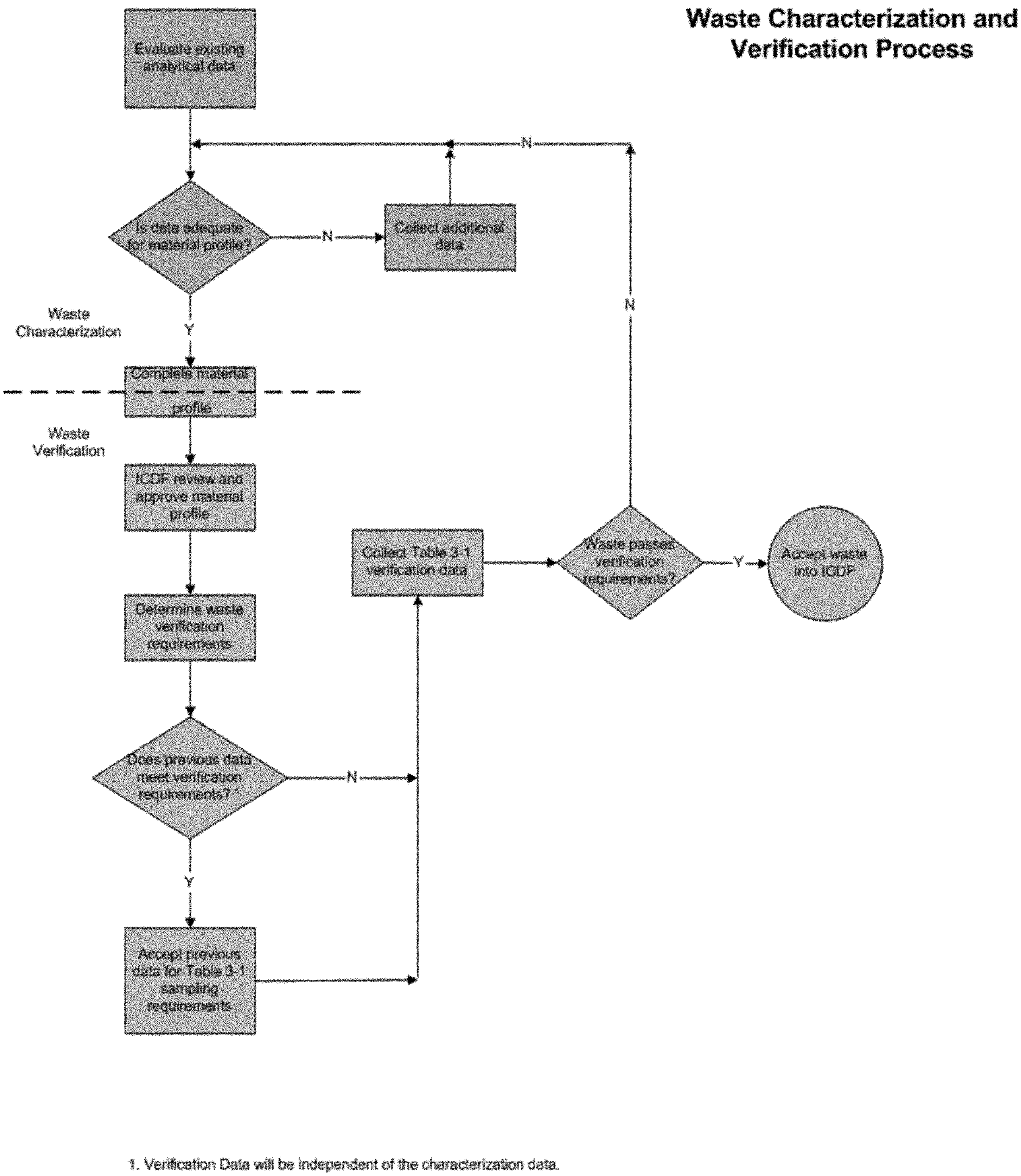

Figure 3-1. Verification process flow.

For sites where in situ waste verification sampling will not be performed prior to excavation, a grid will not be utilized. Rather, a random sample of containers within a lot will be chosen. (A lot being no more than 5,000 yd^3 and a population unit size being at least 15 yd^3.) This applies to waste that is or will be containerized prior to verification sampling. If a previously collected sample is available from that container and it was collected and analyzed using comparable methods and is recent enough so that temporal change is not an issue, it can be utilized for verification of containerized wastes.

All verification samples will be required to be representative of the waste in a given population unit. As such, properties of the COC must be taken into account in order to represent the concentration of the COC in the sample (e.g., for previously containerized waste, an auger sample would be taken if any question of homogeneity in that population unit existed). All samples will be collected following EPA-approved sampling methods.

For waste streams larger than 5,000 yd^3, the waste stream will be divided into approximately equal size lots as close to 5,000 yd^3 as possible. This will be done in order to allocate samples evenly among lots within one waste stream and to maintain a constant population unit size for a waste stream. For example, a waste stream of 7,000 yd^3, would be divided into two lots of 3,500 yd^3 instead of one lot of 5,000 yd^3 and one lot of 2,000 yd^3.

If the waste stream is small enough that approximately 100 population units do not exist (i.e., the waste stream is less than 1,500 yd^3), then the required number of verification samples will be taken from the available population units. If the number of available population units is equal to or less than the required number of verification samples, then each population unit will be sampled.

3.3.4.3 Analytical Method Requirements. Recommended analytical methods to be used for verification samples are discussed in Section 4.2, on a parameter-specific basis. The methods used will depend on the parameter of interest and the detection level required to meet the appropriate percent of the applicable limits.

3.3.5 Assessment of Verification Results

If the results from the required verification (e.g., visual inspection, procedural controls, administrative controls, verification sampling) for key parameters indicate that the waste is within the upper limits of the Material Profile, then the waste can be accepted at the landfill.

For verification involving visual inspections, procedural controls, administrative controls, or field-measured sample results, verification can be obtained in a matter of minutes or hours. For verification involving laboratory analytical results that are required for LDR, landfill COC, or TRU key parameters, verification may take days or weeks. Waste from a lot with concentrations of key parameters that are $\geq$ 20% of the applicable limits will not be placed in the landfill before verification for that lot is complete. Waste from a lot with concentrations of key parameters that are < 20% of the applicable limit may be placed in the landfill before analytical verification results are complete. Acceptance of this waste by the ICDF requires that the ICDF also accepts the risk that some of the waste may fail verification. Waste from a lot that is placed in the landfill and subsequently fails verification is subject to corrective action that could include re-characterization sampling, re-verification sampling, and/or possibly removal of the waste lot from the landfill.

Those verification samples taken prior to excavation will relieve the burden of staging or acceptance of risk from placement prior to receiving verification results. Collection of samples from containers with key parameters at concentrations $\geq$ 20% of the applicable limit could result in staging of waste for extended periods prior to placement in the landfill. This holding of containerized waste should encourage the generator to characterize the waste adequately to delineate high-concentration soils into as small a volume as possible and delineate low-concentration waste (< 20% of the applicable limit) into as large a volume as possible.

3.3.5.1 From Visual Inspections, Procedural Controls, or Administrative Controls. If the results from the visual inspections, procedural controls, or administrative controls indicate that the waste is not as expected on the Material Profile, then the waste will not be accepted at the landfill as is, and corrective action will be initiated. At a minimum, the corrective action would include a review of the source characterization information and a possible revision to the Material Profile by the waste generator. For those waste streams with key parameters determined from mass-based operational limits, if the administrative controls indicate that key parameters are ≥80% of the operation limit, then the action taken could be as simple as delaying placement of the waste until a time that the key parameter is below 80% of the operational limit.

3.3.5.2 From Verification Sampling. For lots within waste streams that require verification sampling, the results from the required verification samples will be compared to the Material Profile. If the maximum sample result for the lot is within the upper limits of Material Profile, then the waste associated with that lot could be placed, or left, in the landfill. If the maximum verification sample result exceeds the upper limit of the Material Profile, then the lot will either not be accepted at the landfill as is and corrective action will be taken to remedy the situation, or the lot placed in the landfill will be subject to corrective action. At a minimum, the corrective action could include revision of the Material Profile by the waste generator, additional verification, including sampling, or rejection of the waste stream.

3.3.5.3 Use of Significant Digits When Assessing Sampling Results. The number of significant digits displayed on the field or portable instrument or as reported from the analytical laboratory will be retained for all verification sample results and will be used as reported in making any decision.

4. SAMPLE AND MEASUREMENT METHODS

4.1 Sample Collection Methods

A scoop, hand corer, auger, or other typical soil sample collection tool will be used to collect verification soil samples. Prior to collection of any samples, the sample tool will be decontaminated to prevent cross-contamination of samples.

For each required verification sample, the sample location within the waste container or from the population unit within the unexcavated site will be chosen to be representative of the waste and the sample will be collected from this location. All samples will be collected in their appropriate containers based on the contaminant and the associated analytical method required for the analytical data. As discussed below in Section 4.2, on-Site analysis and/or off-Site analytical laboratories will be used to obtain the analytical results, depending on the contaminant, required detection level, and analytical technique. For samples associated with on-Site analysis, no sample container is required for those analyses performed in situ. Samples to be analyzed on-Site, but not in situ, will be collected in an appropriate container. All samples requiring off-Site laboratory analysis must be collected in pre-cleaned sample containers and will follow the container requirements identified in Table 2-1 of the QAPjP. If a sample container is required for a volatile organic compound (VOC) or semivolatile organic compound (SVOC) sample, then these will be the first samples collected so that they can be obtained prior to any additional mixing of the soil. The sample will also be taken such that the sample container is completely filled, with minimal headspace to control any loss of target analytes due to aeration.

4.2 Measurement Methods

The following sections present a discussion of the analytical methods that are acceptable for use to obtain the results required for waste verification. Additional analytical methods, not listed in the following sections, may be used to obtain the waste verification results provided there is a standard method with acceptable detection limits. The use of analytical methods will be driven by the Material Profiles received. If the Material Profile indicates that only constituents that can be detected at sufficiently low levels using instruments available at the ICDF are in the waste, then on-Site instrumentation may be used. If the Material Profile indicates that constituents are present that require analytical methods with lower detection limits, the samples will be sent to the appropriate laboratory for analysis. Use of all on-Site analytical methods will follow the manufacturer's operating procedures and any procedures developed to test waste at the required level of detection. Off-Site analytical laboratories will be approved by the INEEL in accordance with applicable laboratory procurement procedures. Table 4-1 provides a summary of the methods discussed in the following sections and method detection limits for each (when available or determined). The methods listed in the table as "Field Methods" are the methods that are most likely to be available at the ICDF site. The methods listed as "Laboratory Methods" are typically performed in off-Site laboratories, but may also be employed at the ICDF if an adequate laboratory capability is developed at the facility.

4.2.1 Methods Applicable to Verification of Key LDR Parameters

The following sections describe the analytical methods that will be used for the various parameter classifications listed in Table 2-2.

4.2.1.1 Volatile Organics. Applicable VOCs must be measured in the soil destined for disposal at the landfill if the Material Profile indicates that a VOC that is subject to the alternative LDR treatment standards for contaminated soils found in 40 CFR 268.49 is present.

Table 4-1. Potential methods for performing the required measurements of constituent concentrations in waste verification samples.

Contaminant Type[a]	Applicable Field Methods[b] (Estimated or Published MDL)	Laboratory Method[c] (Estimated or Published MDL)	Applicable Limit from Tables 2-1 and 2-2	
VOCs	SW-846 5021 or 5035, or TE[d] with Field GC[d] or GC/MS[d,e]	SW-846 5035/8260B (0.005 mg/kg)[f]	40 CFR 268.49, Alternative Soil Treatment Standards:	
			60 mg/kg[g]	
			Landfill WAC:	
			500 mg/kg total VOCs	
SVOCs	SW-846 8275A TE/GC/MS[d] or 3541 or 3550B with Field GC[d] or GC/MS[d,e]	SW-846 3541 or 3550B with 8081A (for kepone only) or 8270C (Method 8081A: ND[d] Method 8270C: 0.66-3.3 mg/kg) [f,h]	40 CFR 268.49, Alternative Soil Treatment Standards:	
			1.3 mg/kg (kepone)	
			18 mg/kg[i] (all others)	
PCBs[j]	SW-846 4020 or 9078 (Method 4020: 5 mg/kg Method 9078: 2 mg/kg)[e]	SW-846 3541 or 3550B and 8082 (0.07 mg/kg)	40 CFR 268.49, Alternative Soil Treatment Standards:	
			100 mg/kg	
Metals:	SW-846 Method 6200 XRF[d]	SW-846 Method 1311 and 6010B ICP[k] or 7000 Series Atomic Absorption Method	40 CFR 268.49, Alternative Soil Treatment Standards:	
			Soil[l]	TCLP
Antimony (Sb)	NA[d]	(0.21 mg/L)	230 mg/kg	11.5 mg/L
Arsenic (As)	(60 mg/kg)	(0.35 mg/L)	1000 mg/kg	50 mg/L
Barium (Ba)	(60 mg/kg)	(0.0087 mg/L)	4200 mg/kg	210 mg/L
Beryllium (Be)	NA	(0.0018 mg/L)	240 mg/kg	12.2 mg/L
Cadmium (Cd)	NA	(0.023 mg/L)	22 mg/kg	1.1 mg/L
Chromium (Cr)	NA	(0.047 mg/L)	120 mg/kg	6.0 mg/L
Lead (Pb)	NA	(0.28 mg/L)	150 mg/kg	7.5 mg/L
Mercury (Hg)	NA	(0.002 mg/L) (Method 7470A)	5 mg/kg	0.25 mg/L
Nickel (Ni)	(100 mg/kg)	(0.10 mg/L)	2200 mg/kg	110 mg/L
Selenium (Se)	(100 mg/kg)	(0.50 mg/L)	1140 mg/kg	57 mg/L
Silver (Ag)	NA	(0.047 mg/L)	28 mg/kg	1.4 mg/L
Thallium (Tl)	NA	(0.27 mg/L)	40 mg/kg	2.0 mg/L
Vanadium (V)	NA	(0.050 mg/L)	320 mg/kg	16 mg/L
Zinc (Zn)	(80 mg/kg)	(0.012 mg/L)	860 mg/kg	43 mg/L
Metals (cont):	SW-846 Method 6200 XRF[d]	SW-846 Method 3050B or 3051 and 6010B ICP[k] or 7000 Series Atomic Absorption Method	Landfill WAC:	
Arsenic	NA	(0.2 mg/kg)(Method 7060A)	58 mg/kg	
Barium	(60 mg/kg)	(2 mg/kg)	3000 mg/kg	
Beryllium	NA	(0.4 mg/kg)	18 mg/kg	
Boron	ND[d]	(8 mg/kg)	3300 mg/kg	
Cobalt	NA	(10 mg/kg)	110 mg/kg	

Table 4-1. (continued).

Contaminant Type[a]	Applicable Field Methods[b] (Estimated or Published MDL)	Laboratory Method[c] (Estimated or Published MDL)	Applicable Limit from Tables 2-1 and 2-2
Manganese	(240 mg/kg)	(2 mg/kg)	4900 mg/kg
Nickel	NA	(20 mg/kg)	350 mg/kg
Thallium	NA	(0.2 mg/kg)(Method 7841)	43 mg/kg
Vanadium	NA	(10 mg/kg)	450 mg/kg
Sulfide	NA	SW-846 Method 9030B, 9031 or 9034 (0.2 mg/kg)	Landfill WAC: 33,000 mg/kg
Cyanide	NA	SW-846 Method 9010 or 9012 (10 mg/kg)	40 CFR 268.49, Alternative Soil Treatment Standards: 300 mg/kg
Radionuclides:			
TRU[m]	NA	Gross Spectrometric Alpha[n] (5 pCi/g)	Landfill WAC: 10 nCi/g
^{238}Pu	NA	Radiochemistry and Alpha Spectroscopy[n] (0.05 pCi/g)	Landfill WAC: 10 nCi/g

a. As identified on the Material Profile.

b. Use of all on-Site analytical methods will follow the manufacturer's operating procedures and a project-specific technical procedure developed to ensure that the method detection limits (MDLs) determined prior to implementation of the method are routinely achieved.

c. Laboratories will be approved by the INEEL in accordance with applicable laboratory procurement procedures.

d. SW-846 (EPA 1999); TE – Thermal extraction equivalent or superior to SW-846 method 8275A; GC – Gas chromatography; GC/MS – Gas chromatography mass spectrometry; NA – Not applicable or the published MDL is not < 20% the action level; ND - Not determined; XRF – x-ray fluorescence.

e. The MDL for analytes determined using sample preparations and instrumentation employed at the ICDF (e.g., in a modular laboratory or in the field) will be determined in accordance with the procedures found in 40 CFR 136 Appendix B prior to implementation of the method. The method will only be applicable to an analyte if the MDL is < 20% the action level for that analyte.

f. MDLs for organic analytes are expressed as published, wet weight estimated quantitation limits (EQLs) that are typically 5-10 times higher than the MDL. Laboratories will report undetected results as dry weight EQLs. Therefore, the EQL reported by the laboratory will be higher than the value listed on this table for samples that contain moisture.

g. The lowest alternative treatment standard for volatile organic compound indicated in the ICDF Design Inventory (EDF-ER-264) as being destined for disposal at the ICDF is 60 mg/kg.

h. Estimated quantitation limits for semivolatile organics are analyte-dependent. Most are 0.66 mg/kg, but those with either poorer extraction efficiency or tendency to break down in the analytical system have an EQL of 3.3 mg/kg.

i. The lowest alternative treatment standards for semivolatile organic compound indicated in the ICDF Design Inventory (EDF-ER-264) as being destined for disposal at the ICDF are 1.3 mg/kg (kepone) and 18 mg/kg (dibenzo(g,h,i)perylene).

j. PCBs – polychlorinated biphenyls.

k. Method 6010B MDLs are based on published instrument detection limits and assume a 1.0-g soil sample with 0% moisture is digested using an acid digestion procedure.

l. The alternative soil treatment Universal Treatment Standard action levels are expressed in mg/L toxicity characteristic leaching procedure (TCLP). The action levels expressed in mg/kg are based on these alternative Universal Treatment Standards and have been converted to mg/kg by multiplying the action level by 20. These mg/kg concentrations are to be used to determine when XRF analyses could be used.

m. Key TRU parameters are defined as alpha-emitting radionuclides with $t_{1/2}$>20 yr (i.e., ^{237}Np, ^{238}Pu, ^{239}Pu, ^{242}Pu, ^{244}Pu, ^{241}Am, ^{243}Am, ^{243}Cm, ^{245}Cm, ^{246}Cm, ^{248}Cm, ^{250}Cm, ^{247}Bk, ^{249}Cf, ^{251}Cf).

n. Refer to ER-SOW-394 for use of this method.

The verification analyses will be done in a laboratory using the SW-846 preparation methods 5021 or 5035 (EPA 1999) followed by the Gas Chromatography Mass Spectrometry GC/MS method 8260B or, at the ICDF, using an alternative method that meets the required detection sensitivity. Examples of alternative methods that may be used include

- A thermal desorber extraction method equivalent or superior to SW-846 method 8275A
- A headspace equilibrium technique equivalent or superior to SW-846 method 5021
- A heated purge and trap technique equivalent or superior to SW-846 method 5035.

Any of the three alternative methods must be followed by analysis on either a GC instrument using a standard operating procedure developed for that instrument (e.g., EPA SOP 2110 [EPA 1994b]).

4.2.1.2 Semivolatile Organics. Applicable semivolatile organic compounds (SVOCs) must be measured in soil destined for disposal at the landfill if the Material Profile indicates that a SVOC that is subject to the alternative LDR treatment standards for contaminated soils found in 40 CFR 268.49 is present. The measurements will be done in a laboratory using SW-846 (EPA 1999) method 3541 or 3550B and 8270C for most of the semivolatile organic compounds of interest, SW-846 method 3541 or 3550B and 8082 for PCBs, SW-846 method 3541 or 3550B and 8081 for kepone, or at the ICDF using an alternative method that meets the required detection sensitivity. Examples of alternative methods that may be used include

- An immunoassay method such as SW-846 4020 (PCBs only)
- An electrochemical method such as SW-846 9078 (PCBs only)
- A thermal desorber extraction method equivalent or superior to SW-846 method 8275A (SVOCs only)
- A traditional solvent extraction method like SW-846 method 3541 (Automated Soxhlet Extraction) or 3550B (Sonication Extract) followed by analysis on either a GC or GC/MS instrument.

4.2.1.3 Inorganics. Applicable inorganic constituents must be measured in soil destined for disposal at the landfill if the Material Profile indicates that an inorganic constituent that is subject to the alternative LDR treatment standards for contaminated soils found in 40 CFR 268.49 is present. The verification of metal constituents will be done by performing analyses in either a laboratory or at the ICDF as indicated in Table 4-1.

The other regulated inorganic constituents that have an applicable alternative LDR treatment standard for contaminated soils found in 40 CFR 268.49 are cyanides. As required by the regulation, cyanides will be determined using SW-846 method 9010 or 9012 (EPA 1999) using a sample size of 10 g and a distillation time of 1 hour and 15 minutes.

4.2.2 Methods Applicable to Determining Verification of the Key Landfill COCs Parameters

The following sections describe the analytical methods that will be used for the various parameter classifications listed in Table 2-2.

4.2.2.1 Toluene. Toluene must be measured in soil being disposed of in the landfill if the Material Profile indicates that it is present at a concentration estimated at $\geq$20 mg/kg. The verification analyses will be done in a laboratory using the SW-846 preparation methods 5021 or 5035 (EPA 1999) followed by the GC/MS method 8260B or at the ICDF using an alternative method that meets the required detection sensitivity. Examples of alternative methods that may be used include

- A thermal desorber extraction method equivalent or superior to SW-846 method 8275A
- A headspace equilibrium technique equivalent or superior to SW-846 method 5021
- A heated purge and trap technique equivalent or superior to SW-846 method 5035.

Any of the three alternative methods must be followed by analysis on either a GC instrument using a standard operating procedure developed for that instrument (e.g., EPA SOP 2110).

4.2.2.2 Inorganics. Applicable inorganic constituents must be measured in soil disposed of in the landfill if the Material Profile indicates that an inorganic constituent listed in Table D-1 of the landfill WAC is present. Methods with appropriate sensitivity for determining the inorganic constituents at concentrations below the action level will be used. The verification for metals constituents will be done by performing analyses in either a laboratory or at the ICDF as indicated in Table 4-1.

The other regulated inorganic constituent that is a key landfill COC is sulfide. Sulfides will be determined using SW-846 method 9030B, 9031, or 9034 (EPA 1999).

4.2.2.3 Radionuclides. Applicable radionuclides must be measured in soil destined for disposal at the landfill if the Material Profile indicates that a radionuclide is present at a concentration estimated at $\geq$80% of the applicable limit listed in Table D-1 of the landfill WAC. The radionuclide of interest that will be sampled for is ^{238}Pu, which will be determined using sample preparation and alpha spectrometry techniques in accordance with an INEEL-approved or standard DOE laboratory method in accordance with the quality assurance and quality control requirements listed in ER-SOW-394.

Refer to Section 4.2.4 for a discussion of the analytical methods applicable to determining verification for TRU activity.

4.2.3 Methods Applicable to Determining Verification of Total Volatile Organics

The average mass of total VOCs in the waste must be verified if the Material Profile indicates that the average concentration for the entire waste stream may be $\geq$400 mg/kg. Refer to Section 4.2.1.1 for a discussion of applicable methods for determining VOCs.

4.2.4 Methods Applicable to Determining Verification of TRU Activity

Applicable radionuclides must be measured in soil being disposed of to the landfill if the Material Profile indicates presence of transuranic radionuclides listed in Section 4.1.4.5 of the landfill WAC document (DOE-ID 2002a). The radionuclides of interest are the transuranic radionuclides (atomic number greater than 92) that are alpha-emitting isotopes with a half life of greater than 20 years. That list includes several radionuclides that tend to be extremely minor contributors to total TRU activity, are used as tracers in radiochemical methods for the most common TRU radionuclides (e.g., ^{243}Am and ^{242}Pu), tend to have very common spectral energies (e.g., the Cm isotopes all have energies very close to ^{241}Am), and/or for which common analytical methods have not been developed. Therefore, the testing of samples requiring determination of total TRU activity will be sent to the INEEL Radiation Measurements

Laboratory (RML) for the gross spectrometric alpha analysis in accordance with the quality assurance and quality control requirements listed in ER-SOW-394. Gross spectrometric alpha is a specialized technique, appropriate for determination of total TRU activity and is only available at the RML.

4.2.5 Detection Limits

The detection limits for the analytical methods used will be dependent on the matrix of the sample and the analytical technique employed. The laboratories used to perform analyses will perform MDL studies prior to implementation of the SW-846 methods (EPA 1999) on waste verification samples. If analytical techniques other than those performed in a fixed laboratory using standard SW-846 methods for organic and inorganic constituents and INEEL-approved methods for radionuclides are used for analysis, MDL studies will be conducted prior to implementation of the method. The detection limits determined for these alternative methods must be ≤20% of the applicable action level for a given analyte in order to qualify as applicable for determination of that analyte. If the method does not meet this detection sensitivity, the samples must be sent to an off-Site laboratory capable of performing methods with adequately low detection limits.

5. SAMPLE CONTROL

Strict sample control is required on every verification event. Sample control ensures that unique sample identifiers are used for separate samples. It also ensures that documentation of sample collection information is such that a sampling event may be reconstructed at a later date. The following sections detail unique sample designation, sample handling (including shipping), and radiological screening of samples.

5.1 Sample Identification Code

All samples collected for verification analyses will be related to the waste stream. The sample locations will be recorded in the sample logbook to maintain a record of verification. The sample numbers scheme will follow the scheme used by the generating site for characterization.

All samples will have a unique sample number identifier to prevent any confusion with sample numbers. The first part of the sample number will be specific to the waste stream being sampled. The waste stream ID will be followed by an underscore. The next character of the sample ID will be a two-character set (e.g., 01, 02) to designate the sequential sample number for the waste stream, followed by a two-character set for designation of type of sample (e.g., VE, FD). The last two characters refer to a particular analysis and bottle type as provided by Sample and Analysis Management (SAM) staff.

In this example, a soil sample collected in support of the WAG 4, Central Facilities Area (CFA) -04 remediation might be designated as CFA020037_03VEAB where (from left to right):

- CFA020037 designates the sample as being collected from a specific waste stream
- 03 designates the sequential sample number for the waste stream
- VE designates the type of sample (VE = verification, FD = field duplicate)
- AB designates gross alpha/beta analysis.

5.2 Sample Designation

5.2.1 General

Sample information will be recorded in a sample field logbook for all samples collected. The following sections describe the sample information that should be recorded in the sample field logbook.

5.2.2 Sample Description

The sample description contains information related to individual sample characteristics. The information described in the remainder of this section will be recorded in the sample field logbook and on the sample container labels.

5.2.2.1 Sampling Activity. The sampling activity contains information related to the remediation site. The sample number in its entirety will be used to link information from other sources (e.g., field data and analytical data) to the applicable waste container for data reporting, sample tracking, and completeness reporting. The unique sample number will also be used by the analytical laboratory, for those samples requiring off-Site laboratory analysis, to track and report analytical results.

5.2.2.2 Sample Location. This is an approximate location from the waste container that the sample was taken.

5.2.2.3 Collection Type. This is information concerning the type of sample collected, e.g., grab sample.

5.2.2.4 Sample Date. The sample date is essential information due to sample holding times.

5.3 Sample Handling and Analysis

Samples requiring laboratory analysis will be collected in pre-cleaned containers and packaged according to American Society for Testing and Materials or EPA-recommended procedures.

5.3.1 Sample Preservation

Soil samples taken and analyzed on-Site do not require preservation if the analyses are performed immediately or in situ. Samples collected for later preparation and analysis for organic constituents and metals when mercury analysis is required will be preserved at 4° C $\pm$ 2° C. Samples collected for the analysis of radionuclides do not require preservation. All samples sent to contracted laboratories will be preserved as indicated in the analytical laboratory Statement of Work (SOW).

5.3.2 Chain-of-Custody Procedures

Sample containers will be stored in a secured area accessible only to the field team members. The chain-of-custody procedures specified in the QAPjP will be followed for all analytical laboratory samples. Chain-of-custody procedures are not applicable to those samples analyzed using on-Site methods since the samples are either analyzed immediately or in situ or are always in a secure location after initial custody is secured (i.e., custody is never transferred).

5.3.3 Transportation of Samples

Samples requiring analysis by off-Site analytical laboratories will be shipped in accordance with the regulations issued by the Department of Transportation (DOT) (49 CFR 171 through 49 CFR 178) and EPA sample handling, packaging, and shipping methods (40 CFR 262).

5.3.3.1 Custody Seals. Custody seals will be placed on all shipping containers in such a way as to ensure that tampering or unauthorized opening does not compromise sample integrity. Clear plastic tape will be placed over the seals to ensure that the seals are not damaged during shipment.

5.3.3.2 On-Site and Off-Site Shipping. An on-Site shipment is any transfer of material within the perimeter of the INEEL. Site-specific requirements for transporting samples within INEEL boundaries and those required by the shipping and receiving department will be followed. Shipment within the INEEL boundaries will conform to DOT requirements as stated in 49 CFR Parts 171–178. Off-Site shipments will conform to all applicable DOT requirements.

5.3.4 Sample Analysis

The INEEL will prepare a Task Order Statement of Work (TOS) for laboratory services for the required analyses that will be conducted at a location other than at the ICDF. For the verification sampling, the only required field quality control samples will be duplicates. These samples will also be included in the TOS.

All samples will be collected and shipped, if required, in accordance with the QAPjP. Laboratories approved by the INEEL in accordance with applicable laboratory procurement procedures will perform all off-Site laboratory sample analysis. The INEEL-approved laboratories will perform the analyses in accordance with all applicable SOWs and TOSs.

All field analytical measurements will be performed in accordance with manufacturer's operating procedures and published methods or technical procedures developed to support the specific analysis being performed.

5.4 Radiological Screening

If samples are to be removed from the area and shipped or delivered to a laboratory, the samples will be surveyed for external contamination and radiation levels. If necessary, a gamma-screening sample will be collected and submitted to an on-Site analytical laboratory for a 20-min analysis prior to shipment off-Site. The field radiological control technician will make a determination of the need for gamma screening.

6. PROJECT QUALITY OBJECTIVES

The project quality objectives specify the measurements that must be met to produce acceptable data for a project. The technical and statistical qualities of these measurements must be properly documented. Precision, accuracy, and completeness are quantitative parameters that must be specified for physical/chemical measurements. Comparability and representativeness are qualitative parameters.

The project quality objectives will be met through a combination of field and laboratory checks. Field checks will consist of collecting field duplicates. For those samples requiring off-Site laboratory analysis, laboratory checks consist of initial and continuing calibration samples, laboratory control samples, matrix spikes, and matrix spike duplicates. Laboratory quality assurance is detailed in the QAPjP.

Data associated with the verification samples will be obtained from various methods, depending on the contaminant and the specific verification requirements. Recommended methods are listed in Table 4-1 and include on-Site analysis and off-Site laboratory analysis. The project quality objectives will be addressed separately for the results from on-Site analytical methods and those from an outside analytical laboratory, due to the different analytical requirements associated with the methods.

6.1 Quality Objective Parameters

6.1.1 Field Precision

Field precision is a measure of the variability not due to laboratory or analytical methods. The three types of field variability or heterogeneity are spatially within a data population, between individual samples, and within an individual sample. Although the heterogeneity between and within samples can be evaluated using duplicate and/or sample splits, overall field precision will be calculated as the relative percent difference between two measurements, or relative standard deviation between three or more measurements. The relative percent difference or relative standard deviation will be calculated as indicated in the QAPjP, for duplicate samples. To account for the uncertainty in radiological measurements, the mean difference will be calculated. For the results obtained from an outside analytical laboratory, the relative percent differences for inorganic and organic parameters are calculated by the laboratory and are indicated on quality control data reporting forms. For results from on-Site analytical methods, relative percent difference will be calculated from the duplicate results and will be recorded in the appropriate logbook. Mean differences for radiological parameters from either on-Site or off-Site methods will be calculated and recorded in the appropriate logbook.

6.1.2 Field Accuracy

Accuracy of field instrumentation will be maintained by calibrating all instruments used to collect data. Accuracy of laboratory measurements will be determined by following prescribed analytical methods and performing the required project quality analyses for the specified method. Accuracy can be measured through the use of surrogate spikes (organic analyses), matrix spikes, laboratory control samples (LCS), and performance evaluation sample materials. The use of surrogate spikes and matrix spikes are an inherent part of some the analytical methods that will be used for verification measurements. Performance evaluation sample materials will not be routinely used, but performance samples of INEEL soil matrix that have been used by the Radiological Environmental Sciences Laboratory for the DOE Mixed Analyte Performance Evaluation Program may be used as an LCS material for measurements performed using XRF at the ICDF.

6.1.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which the sampling and analysis data accurately and precisely represent the population parameter that drives an action to be taken. In essence, representativeness is a qualitative parameter that addresses whether the sampling program was properly designed to meet the DQOs. Representativeness will be evaluated by determining whether measurements are made and physical samples are collected in such a manner that the resulting data appropriately approximate the population parameter of interest. Confirming that sampling locations are selected properly and a sufficient number of samples are collected to meet the requirements stated in the DQOs are the best ways to evaluate the representativeness criterion.

6.1.4 Comparability

Comparability is a qualitative characteristic that refers to the confidence with which one data set can be compared to another. For the verification samples, results from within a given waste stream will be compared to a maximum concentration obtained from previous studies. At a minimum, comparable data must be obtained using unbiased sampling designs. Data comparability will be assessed through the comparison of all data sets collected for the particular waste stream being sampled using the following parameters:

- Units will be expressed in common metrics.
- Analytical procedures with appropriately low detection limits relative to the action level will be used to collect data for a given contaminant.
- Standard methods of sample collection and handling will be followed.
- Methods chosen for analysis may vary for a given analyte, but care will be taken to ensure detection limits for the analyte are sufficiently low, regardless of the method chosen, to make comparable decisions relative to the action level.
- Samples within data sets will be selected in a similar manner.

6.1.5 Completeness

Completeness is a measure of the quantity of usable data collected during the field sampling activities. The QAPjP requires that an overall completeness goal of 90% be achieved for noncritical samples. If critical parameters or samples are identified, a 100% completeness goal is specified. Critical data points are those sample locations or parameters for which valid data must be obtained in order for the sampling event to be considered complete.

Field completeness will be assessed by comparing the number of samples collected to the number of samples planned. Field sampling completeness is affected by such factors as equipment and instrument malfunctions and insufficient sample recovery. Completeness will be assessed following data validation and reduction.

Because of the critical nature of the data being collected in support of the verification sampling, the completeness goal for the sampling efforts will be 100%.

6.2 Field Data Reduction

The reduction of field data is important to ensure that there have been no errors in sample labeling and documentation. The sample team will review all field data for accuracy. This review includes cross-referencing the samples that are collected with sample labels, logbooks, and chain-of-custody forms, if required. Prior to sample shipment to the laboratory, or upon completion of daily sampling activities, field personnel will ensure that all field information is properly documented. Review of the sample field logbooks will be performed to ensure all required information is properly documented.

6.3 Data Validation

Method data validation is the process whereby analytical data are reviewed against set criteria to ensure that the results conform to the requirements of the analytical method and any other specified requirements. A cursory contractual compliance review of all laboratory data will be performed to ensure that contractual requirements have been met. This cursory review could include, but is not limited to, ensuring the following:

- The analytical laboratory performed the requested methods.
- Holding times were met.
- All required analytes were included in the calibration standards for the method.
- All samples shipped were analyzed.
- All quality control samples were run at the appropriate frequency.

Field-generated data will be validated by periodic reviews of data to ensure proper calibration of the instrument and other data collection activities were appropriately documented in a bound sample or field logbook. The quality of field-generated data will be ensured through adherence to the manufacturer's operating procedures, conformance to any specific technical procedures prepared for the analyses conducted, and use of equipment calibration, as appropriate.

7. DATA MANAGEMENT/DATA ANALYSIS AND UNUSUAL OCCURRENCES

All samples will be recorded in the appropriate sample field logbook. Analytical results, taken on-Site using methods specified in Table 4-1, will also be recorded in the appropriate sample field logbook. If an on-Site analytical method produces a printed analytical report, the report will be retained in the project file. If the field instrument requires quality control checks, calibrations, etc., this information will be saved and placed in the project file.

Analytical results obtained from an off-Site analytical laboratory will be managed and maintained by the INEEL, in accordance with applicable procedures.

This section discusses the approach to managing the data, analysis of data, and suggested responses to unusual occurrences associated with verification sample data.

7.1 Data Management

The following sections present the processes associated with managing the data collected for verification samples.

7.1.1 On-Site Analytical Data

On-Site analytical sample data will be managed and tracked by the ICDF waste specialist (or designee) and maintained by the ICDF Complex in accordance with approved procedures. Since on-Site analytical sample data result from field instrumentation, standard company procedures for data validation are not applicable.

7.1.2 Off-Site Laboratory Analytical Data

Off-Site laboratory analytical samples and related data will be managed and maintained by the INEEL in order to ensure an efficient and accurate means of sample and data tracking.

ICDF samplers will be responsible for taking the sample, preparing the sample shipment, and shipping the sample to the analytical laboratory. The INEEL will begin tracking analytical laboratory sample data once the samples are shipped to the INEEL-contracted laboratory. Laboratory compliance includes adherence to sample holding times, requested analytical methods, and data deliverables. When the laboratory analytical data package, or sample delivery group (SDG), is received from the laboratory, cursory technical reviews on the data packages are performed to assess the completeness and technical compliance with respect to the project's analysis-specific TOS or SOW. Errors in a data package will be resolved among ICDF project personnel, the INEEL chemist(s), the originating lab, and SAM.

7.1.3 Field Data

Field data taken in support of the laboratory analytical samples include all data that are nonchemical analytical data. These data will be managed by INEEL according to applicable procedures.

7.2 Data Analysis

7.2.1 On-Site Analytical Data

On-Site analytical methods will be used to obtain analytical data results for some contaminant types. All analytical data resulting from these on-Site methods will be reviewed by a qualified technician.

7.2.2 Off-Site Laboratory Analytical Data

Some verification samples may require off-Site laboratory analysis. A cursory contractual compliance review of all laboratory data will be performed to ensure that contractual requirements have been met (refer to Section 6.3).

7.2.3 Field Data

Field data will be analyzed using methods that are appropriate for the data types and specific field conditions. Analysis will include recognized methods and techniques that are used with the specific data types and may include statistical processes (e.g., instrument quality control checks).

7.3 Unusual Occurrences

Unusual occurrences are situations that are unforeseen, unanticipated, or unexpected. They may occur in chemical data sets or as field-related data and observations. An example of an unusual occurrence is detection of a contaminant where previously it was undetected or inability to obtain a required sample.

The following is meant to provide a process for resolving an unusual occurrence rather than a method for dealing with each specific unusual occurrence. The following steps will be taken to resolve an unusual occurrence:

- Record the unusual occurrence and supporting observations in the sample field logbook.

- Validate the unusual occurrence (e.g., reanalyze the sample if any remaining) and report to program manager as soon as possible.

- If the unusual occurrence is of a significant nature (significant is anything that can impact the decisions to be made with the verification results), it will be reported to the appropriate ICDF personnel. Agency notification will only be made if the waste is improperly disposed of in the landfill.

- If the unusual occurrence is not of a significant nature (e.g., malfunctioning instrument), it will be resolved by the technical leader and is a non-issue.

8. WASTE MANAGEMENT

Waste may be generated as a result of the verification sampling activities described in this plan. Wastes that may be generated include the following:

- Personal protective equipment
- Contaminated sample equipment
- Used sample containers and disposable sampling equipment
- Liquid or solid decontamination residue
- Miscellaneous wastes.

These wastes will be containerized appropriately and will be added to the appropriate Material Profile generated by the ICDF user. If a Material Profile for this type of waste does not exist, the ICDF user will generate a new profile for management of these wastes. Since liquid wastes cannot be disposed of to the landfill, disposition of liquid waste will be handled by the appropriate Waste Management Plan.

9. HEALTH AND SAFETY

Work performed for the verification sampling of soil wastes destined for direct disposal at the landfill will be performed in accordance with the *Health and Safety Plan for INEEL CERCLA Disposal Facility Operations* (INEEL 2003).

10. DOCUMENT MANAGEMENT

Documentation includes sample field logbooks used to record field data and on-Site analytical results, sampling procedures, chain-of-custody forms, and sample container labels. All documents associated with verification sampling data will be maintained and managed in accordance with approved applicable ICDF and applicable procedures.

The ICDF Complex will be responsible for controlling and maintaining all documents and records relating to verification sampling and for verifying that all required documents to be submitted to the INEEL are maintained in good condition. All entries will be made in indelible black ink. Errors will be corrected by drawing a single line through the error and entering the correct information. All corrections will be initialed and dated.

10.1 Sample Container Labels

Waterproof, gummed labels will display information such as the unique sample identification number, the name of the project, sample location, and analysis type. Labels will be completed and placed on the containers before collecting the sample. Sample team members will provide information necessary for label completion. Such information may include sample date, time, preservative used, field measurements of hazards, and the sampler's initials.

10.2 Field Logbooks

Bound field logbooks, with sequentially numbered pages, will be used to record information necessary to interpret the analytical data. All field logbooks will be controlled and managed according to applicable company and ICDF procedures.

10.2.1 Sample/Shipping Logbook

The sampling team will use a sample field logbook to record information relating to collecting verification samples. Each sample field logbook will contain information such as

- Physical measurements for on-Site analytical results (if applicable). If the field instrument is equipped with a print-out, the print-out will be attached to the appropriate page of the logbook.
- All required quality control samples (e.g., duplicates).
- Shipping information for samples requiring off-Site laboratory analysis (e.g., collection dates, shipping dates, cooler ID number, destination, chain-of-custody number, name of shipper).
- All team activities.
- Problems encountered.

This logbook will be signed and dated at the end of each day’s sampling activities.

10.2.2 Field Instruments Calibration/Standardization Logbook

A logbook containing records-of-calibration data will be maintained for on-Site analytical methods for each piece of equipment requiring periodic calibration or standardization. This logbook will contain log sheets to record the date, time, method of calibration, and instrument ID number.

10.2.3 Field Supervisor's Daily Logbook

A project logbook maintained by the ICDF field supervisor, or designee, will contain a daily summary of the following:

- All field team activities
- Visitor log
- List of site contacts
- Problems encountered
- Any corrective actions taken as a result of field audits.

This logbook will be signed and dated at the end of each day's sampling activities.

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Appendix A

Procedure for Determining If Free Liquids Can Be Generated from Waste Prior to Transport

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Procedure for Determining If Free Liquids Can Be Generated from Waste Prior to Transport

During the excavation, stockpiling, and loading of waste at each of the Remedial Action (RA) sites, there is a wide range of possible weather conditions that may be encountered. During usual construction seasons, the excavated soils are significantly dry of optimum and have no chance of producing free liquids during transport to the ICDF Complex. If stockpiles have been left uncovered over the winter or the soils are handled during significantly wet weather, then the potential exists for significant moisture to be present. It is generally easy to determine if soils are wet or dry of optimum based on squeezing the soil and seeing how it behaves. Soils that are dry of optimum crumble easily and it is clear there is not enough water to produce free liquids. Soils that are wet of optimum visually appear wet and it is easy to see the dilatancy effects of water in the soil which indicate the soils are wet of optimum.

When visual observations of soil show moisture contents wet of optimum, the following procedure is suggested as an easy field method for determining if the potential exists to generate free liquids during transport of waste:

1. Place a couple shovels of representative waste in a porous sand bag or geotextile bag.

2. Place sand bag in a pie tin or other container with sides on a vibratory table similar to that specified in ASTM D4253 for the relative density test. Turn on vibratory table for a minimum of 5 minutes and observe if any free liquids are present.

3. When visual observations identified above indicate soils wet of optimum, the vibratory test shall be performed on representative samples at least 3 times per day. This test shall also be performed when significant changes in material type occurs during excavation.

4. If the test generates free liquids, then the waste has the potential for generating free liquid during transport and the waste should be allowed to dry or by working the soil through discing or in thin lifts. Another alternative for controlling free liquids would be to add absorbent material to the wastes during loading. If no free liquid is generated during the test, then the waste does not have the potential for generating free liquids and can be transported to the ICDF.